S207 The Physical World

Course Guide

READ THIS FIRST!

Contents

Printed in the United Kingdom

SUP 02248 7

8.1

1 Introduction

Welcome to S207 *The Physical World*, and congratulations on making a very astute choice of course and subject! We hope that you will enjoy it. The purpose of this document is to summarize what the course is about, to outline its overall structure, to point out some of the relationships between the various course components, and to act as a source of information to which you may refer during your studies. This section provides the information you will need before getting started on S207.

It is important that you regularly check the S207 course website. Log on to your StudentHome page (http://www.open.ac.uk/students) and you will see a link to the course website. You will need to sign in using your OU computer username and password to access your StudentHome page.

We will use this website to distribute the tutor-marked assignments (TMAs) and as the primary method for communicating important notices, as well as hints and tips on how to answer your TMAs. The website also contains important course resources and an electronic study planner. On it you will also find a link to the course forums.

1.1 The structure and content of S207

The course is based on eight printed books. Each of these is supported by video sequences and computer activities, all of which are on DVD-ROM. The book titles are:

1 *The restless Universe* (*RU*)

2 *Describing motion* (*DM*)

3 *Predicting motion* (*PM*)

4 *Classical physics of matter* (*CPM*)

5 *Static fields and potentials* (*SFP*)

6 *Dynamic fields and waves* (*DFW*)

7 *Quantum physics: an introduction* (*QPI*)

8 *Quantum physics of matter* (*QPM*)

Please note the abbreviation in brackets given for each book: they are used for references to the books in the Glossary and assignments.

***The restless Universe* (*RU*)** provides a non-mathematical overview of physics that brings together the biggest ideas from every part of the subject. The associated video and multimedia activity will introduce the scale of the Universe in time and space, and indicate the range of objects and phenomena that physics aims to describe.

***Describing motion* (*DM*)** deals with the various forms of motion that arise in the physical world and the quantitative methods used to describe them. This book also introduces many of the essential mathematical tools that you will need later in the course.

***Predicting motion* (*PM*)** presents force as the cause of change in the physical world, and considers the way in which the effect of forces can be predicted. Vital concepts such as energy and momentum are explored.

***Classical physics of matter* (*CPM*)** uses classical physics to explain the behaviour of gases, liquids and solids. Some of the explanations are microscopic in character, relating the properties of matter to the random motion of atoms and molecules. Other explanations are on a larger scale, involving the laws of thermodynamics and fluid dynamics. Applications include the Earth's atmosphere, engines, refrigerators and flight.

***Static fields and potentials* (*SFP*)** describes two of the fundamental interactions in Nature – gravitation and electromagnetism. The associated fields and potentials are introduced and their interrelationship explained. You will also see how these ideas are harnessed in applications as diverse as hydroelectric power generation, electrical circuitry and DNA fingerprinting.

***Dynamic fields and waves* (*DFW*)** concentrates on electric and magnetic fields that vary with time, including the electromagnetic waves that constitute light and a host of related phenomena. This book also contains an introduction to Einstein's theory of relativity which provides our most fundamental insights into space and time.

***Quantum physics: an introduction* (*QPI*)** guides you through the revolution in scientific thinking that overthrew classical physics in favour of quantum physics. You will learn the basic ideas of quantum physics and see their power in predicting the behaviour of matter on the atomic scale.

***Quantum physics of matter* (*QPM*)** explores the way in which quantum physics determines the properties of matter. The quantum physics of solids, for example, dictates whether they are good insulators, conductors, semiconductors or even superconductors. At a deeper level, the quantum physics of nuclei and elementary particles determines the stability of matter, and hence the range of substances that came to exist via the Big Bang and the subsequent evolution of the Universe.

1.2 The components of S207

(a) The **books** described above provide the principal focus of the course. Each book is divided into chapters and ends with an index. Most of the chapters should be started and finished within a single week, but some are only a half or three-quarters of the usual length, and a few are one and a quarter or one and a half times the usual length. An indication of the amount of time you should spend on each chapter is provided by the *Study Planner*, which suggests a week-by-week study pattern. Apart from *The restless Universe*, each book contains a final chapter devoted to consolidation and skills development that will help you to revise the content of the book and develop some general skills that can be used elsewhere in your studies.

(b) The **Maths Handbook** contains a coherent summary of all the mathematical techniques that appear in the course, together with some questions and examples that will help you to apply those ideas in a physical setting. It also contains listings of mathematical symbols, the Greek alphabet, physical constants, SI units and conversion factors. If you have difficulty following the mathematical arguments presented in the early parts of the course, particularly in *Describing motion*, you will probably find it helpful to work through the examples and questions contained in the early sections of the *Maths Handbook.* Don't neglect this important document.

(c) The **Glossary** contains concise definitions of all the key scientific concepts introduced in the course. It is arranged alphabetically, and includes references to the relevant books. Some concepts become increasingly developed and refined as the course progresses; you can trace such developments by noting how the definition changes from book to book. If you are unsure of a particular concept, try looking it up in the *Glossary* and tracing through all the cross-references and book references that you find there.

(d) The **multimedia activities** play a vital role in the course. There are a number of topic-based computer activities. These are designed to support and reinforce the teaching of some of the most important concepts in the course. In addition, each topic-based computer activity also contains a set of interactive questions. You will find special notes in the books telling you at what stage you should make use of the various packages and questions. You will also find that the computer activity you should be studying in any particular week is indicated in the *Study Planner*.

(e) There are eight **video programmes** on the DVD-ROMs that support the books. Each programme lasts about 30 minutes and is dedicated to one of the eight books. The best way to use each video programme is explained in a note that appears at the end of the introduction to each book. In some cases the video provides general support for a book and may be viewed at any time during your study of the book; in others the video is associated with a particular section, as indicated in the *Study Planner*. In all cases the videos are intended to be enjoyable and motivating; there are *no* associated video notes.

(f) The **tutorials** will be organized by the staff of your Regional Centre. The Centre will tell you who your tutor is, and he or she will mark your TMAs as well as presenting the tutorials. Your tutor is the first person to contact if you have any academic questions about S207.

(g) The **assignments** are part of the teaching process as well as a means of assessment. There is one CMA and seven TMAs, all of which count towards your course result. All the cut-off dates are listed in the *Study Planner*. These cut-off dates are important; a CMA *cannot* be marked if submitted after its cut-off date and late submission of a TMA requires the prior agreement of your tutor or Regional Centre (consult the *Assessment Handbook* for details of the procedure). Table 1 (see Section 2) shows how the assignments contribute to your final grade and lists the coverage of each assignment.

(h) The **final examination** lasts three hours and assesses the whole course. The paper consists of three parts. Part 1 carries 40% of the marks, and is devoted to short, multiple-choice, questions covering the entire course. Part 2, worth 20%, concentrates on glossary-style definitions of key concepts. Part 3 is worth 40% and requires you to answer four problem-type questions from a choice of seven. On the course website you will find a *Specimen Examination Paper* (together with answers) to show you broadly what to expect. It is worth noting that the *Specimen Examination Paper* includes the *Standard Equations and Constants* booklet, and that an identical booklet will be provided with your final examination paper. You are encouraged to become familiar with the equation list as you work through the course. You should also note that some questions in the examination may be similar to questions in the consolidation and skills development chapters (this includes the questions on the associated DVD-ROM). You will enhance your chances of passing the examination by ensuring that you work through those chapters, paying close attention to all the questions and answers they contain, both in print, and on the DVD-ROM.

1.3 The S207 DVDs and software

Along with your other course materials you will be sent two DVDs containing a number of computer-aided learning activities plus all the video sequences for the course. The first contains material associated with Books 1–4 and the second contains material related to Books 5–8. The DVDs include both software and video sequences. The software activities require that you use the DVD in a personal computer running *Microsoft® Windows™*. The video sequences may be viewed either on a PC or by inserting the DVDs in a domestic DVD player connected to a TV.

The S207 software activities are designed to provide you with a richer set of learning environments than a traditional paper-based course can offer. If you have studied other Open University courses using a computer you may be familiar with this style of learning; if not, you may find it very different from other study methods.

The software activities on the DVDs fall into two categories:

1 Interactive multimedia tutorial packages. There are more than a dozen of these, each of which will take an hour or so to complete.

2 A set of interactive questions (with answers) is provided to cover material in each course book, and working through these will reinforce your learning and provide feedback on areas with which you are having difficulties.

All of the multimedia activities are accessed through the S207 *Multimedia Guide*. When you first insert the S207 DVDs into your computer, you must start by installing it. Click on the **Install** button to do this. During the installation, you are offered a number of choices. We recommend that you accept the default suggestions where possible. An icon for the S207 *Multimedia Guide* will be added to the S207 folder on the **Programs** menu of the **Start** button.

The S207 *Multimedia Guide* indicates the study time for each package before you start it. You may wish to study each package in its entirety; or you can tackle just some sections and return to the package at a later time. The S207 Question packages keep track of your performance so that you can refer back later. This is for your use only – we have no way of collecting this information! To delete the record of a particular package, use the menu item **Erase progress records** (from the **File** menu).

As with any medium, you may not absorb all the content first time. There are controls to allow you to pause and replay any audio and video, so you can retrace your steps if you want to check a point you may have missed. Many packages will ask you questions. Attempting to answer these questions will reinforce your learning, and allow you to assess your own understanding. Don't worry if you get the answer wrong! You will get another attempt at answering the same question, perhaps with a clue. Some of the interactive question packages associated with the books will generate different questions each time they are used, so you can use these for revision.

We hope you will find learning with interactive multimedia engaging and rewarding. However, it can be easy to overlook the aim of the activity and spend time exploring at random. For example, some packages contain simulations that you can use to explore a *physical* system. Do explore these systems as much as you wish, but remember that a good explorer has a goal in mind and does not wander at random. To keep an aim in view, ask yourself, 'What will happen if…?', try to predict the outcome, and then test your prediction.

2 Course assessment and learning outcomes

This section contains information you may need during the course and when revising.

2.1 The assignments

The S207 assignments carry 50% of the total marks for the course. Apart from Book 1, *The restless Universe*, each of the books is covered by a single TMA. TMAs 1 to 6 cover Books 2 to 7, respectively, and TMA 7 comprises two parts. The first part assesses the material in Book 8. The second part is very similar to Part 1 of the exam; it contains 12 short multiple-choice style questions covering Books 2 to 8. In addition, a CMA tests the mathematical aspects of Chapters 1 and 2 of *Describing motion* and the *Maths Handbook*. The main purpose of this CMA is to alert you and your tutor to any difficulties that you might experience with the mathematical aspects of the course. S207 is a physics course and it is important that its mathematical content should aid your studies rather than hinder them. If you are likely to encounter problems concerning the mathematics in S207, it's best to identify and resolve them at the earliest possible stage in your studies.

Only one TMA is substitutable. The working of the substitution rule is described in the Assignments section of the current *Assessment Handbook*. **Remember that submitting all your assignments will always give you a better overall mark than submitting all but one, even if you get a very low grade on the one you are tempted to omit.**

Table 1 Weighting and coverage of assessment components

Assessment component	Coverage	% of course mark
CMA 41	Mathematical aspects of *DM* Chapters 1 and 2 and the *Maths Handbook*	2.75
TMA 01	*DM*	6.75
TMA 02	*PM*	6.75
TMA 03	*CPM*	6.75
TMA 04	*SFP*	6.75
TMA 05	*DFW*	6.75
TMA 06	*QPI*	6.75
TMA 07	*QPM*/all	6.75
Examination	Whole course	50
		total 100

2.2 The final examination

The S207 examination carries 50% of the total marks for the course. You must attempt the questions without the aid of any notes or printed material relating to the course, although the examination paper will include the *Standard Equations and Constants* booklet. The examination paper will be similar in style and level to

the *Specimen Examination Paper*. A basic scientific calculator is considered to be essential for the S207 examination and the minimum features it should have are arithmetic, simple trigonometric and logarithmic functions. **This calculator must not be programmable, and must not be able to store text.** Taking notes into the examination, in any form (including any stored in your calculator), would be considered cheating.

Your final result status will depend on your continuous assessment grades, as well as on your examination performance. The matrix used to compute result status is illustrated in the Course Results section of the *Assessment Handbook*. In order to pass the course you MUST achieve pass marks on BOTH the examination and the continuous assessment. A very high continuous assessment score does not mean that you can skip the exam.

Performance on all Open University assignments and examinations will be recorded and reported back to you using a numerical scale (the University Scale) with the interpretation shown in Table 2.

Please note, however, that the borderlines shown on the University scale are upper limits and the exam pass mark on this course is always lower than 40.

A student who achieves a Pass 4 standard both on continuous assessment and on the examination will automatically qualify for a result status of Pass 4, and similarly for other result statuses. Students who achieve a score near the top of a band in both may be awarded a higher grade at the discretion of the examiners.

For S207, the distribution of scores is likely to vary between the two components of the assessment. We would expect most students to achieve higher scores in TMAs than in the examination.

Table 2 The University Scale

Band	University Scale score	Performance standard
A	85–100	Pass 1
B	70–84	Pass 2
C	55–69	Pass 3
D	40–54	Pass 4
E	30–39	Bare fail
F	15–29	Fail
G	0–14	Bad fail

2.3 Aims and learning outcomes

The main aims of S207 are:

1 To provide a broad and stimulating introduction to physics, covering all the main ideas, which are set in their historical context and illustrated with many real-world examples and applications.

2 To develop the skills necessary for the efficient learning of physics at Level 2.

3 To continue the development of skills appropriate to independent learning.

All of the components of the course contribute in varying degrees to supporting these aims. There are a number of general learning outcomes for the course that we hope you will achieve. The course assessment (the CMA, the TMAs and the

exam) are designed to assess your progress towards achieving these learning outcomes. The learning outcomes are detailed below.

2.3.1 Knowledge and understanding

During your study you should build your knowledge and understanding of the following areas of physics, and you should be able to demonstrate proficiency in each:

1 The various forms of motion that occur in the physical world, their description and prediction. The concepts and quantities relevant to this, e.g. velocity, force, momentum, torque, etc. and their interrelationships.

2 The basic ideas about heat, thermodynamics, entropy, statistical physics and the basic principles of flight.

3 The fundamentals of electrostatics, gravitation and magnetism, including the concepts of field, potential and potential energy and their interrelationships.

4 Waves, particularly light and electromagnetic waves, optical instruments and the processes of reflection, refraction and diffraction.

5 The basic principles of special relativity.

6 Quantum mechanics, including Schrödinger's equation and its solution for very simple potentials. How QM is applied to the hydrogen atom and heavy atoms and their spectra. Interpretation of quantum mechanics.

7 Quantum physics of matter, i.e. the nature of solids, nuclei and elementary particles.

2.3.2 Cognitive skills

During your study you will need to develop the following cognitive skills:

1 The ability to analyse and overcome prejudices and misconceptions about the physical world especially with regard to the nature of motion.

2 The skills appropriate to the understanding and use of scientific concepts and the application of those concepts in relevant situations.

3 The ability to apply suitable problem-solving techniques, including mathematical and diagrammatical methods.

4 The ability to explain abstract and/or counterintuitive physical concepts.

5 The ability to absorb and present information in a variety of forms, e.g. text, numerical, graphical, diagrammatic or as a computer simulation.

6 The ability to apply physical principles and models to different areas of physics.

7 An appreciation of some of the philosophical issues raised by physics.

2.3.3 Key skills

In order to meet the learning outcomes detailed above it will be necessary for you to be able to develop and apply a number of key skills:

1 The use of text, equations, diagrams and numerical data to communicate physical concepts.

2 The ability to apply relevant mathematical techniques, e.g. simple calculus, vectors, algebra, in order to understand physical models, and in solving problems.

3 The ability to install, run and navigate a multimedia package.

4 The ability to solve problems using both computer-based and non-computer-based techniques.

5 The use of time management and organizational skills to effectively plan and complete your study and meet deadlines.

3 Assignment guide: general advice about S207 assignments

This section provides some general guidance on how to approach the tutor-marked assignments (TMAs) in S207. You should read this advice *before* you tackle the assignments. *The Sciences Good Study Guide* (*SGSG*) provides additional advice on tackling assignments, and you may also find it useful to look at the study resources and toolkits at http://www.open.ac.uk/learning/ .

3.1 When and how to start work on a TMA

For each question in the TMAs, we indicate which sections of the books we are assessing, and you will probably find it useful to read through the assignment questions *before* you begin detailed study of the relevant course text.

When is the best time to do the questions that relate to a particular section of the course text? One approach would be to begin them straight after you have studied the relevant course material. However, we recognize that you may well find it difficult always to put this approach into practice! Another approach is to wait until you have finished a particular book and can see the material in a broader context. If you do this, you will need to build in plenty of time to your study schedule to complete the TMA. You may be tempted to leave your assignments until just before the cut-off date, thinking that the longer you leave it the better you will understand the course material. Try to avoid this – it is far better to organize your time so that you make a first attempt at assignment questions when you have completed reading the relevant section of the course text and when the material is fresh in your mind. Even if you don't have time to answer a question properly, you will find it useful to make some notes relating to the question immediately after studying the relevant material. You can then complete your answers later on.

As well as their role in assessing your progress through the course, all questions have various other goals – to help you to reinforce your understanding of concepts, practise certain skills, or make links between the different sections of a book, or even between books.

3.2 Answering the questions

- Tutors will always tell you that more marks are lost in assignments by students failing to answer the question in the way that is asked than for any other reason. Questions are carefully worded to elicit specific answers. You should not regard them as an opportunity to write everything you know about a topic.
- Read the whole question very carefully before starting to answer any part and make sure that you understand what is being asked for. If you are uncertain, you can always discuss the wording with other students or with your tutor.
- Check the meanings of any words that you are uncertain about by using the *Glossary* or a dictionary.
- Pay particular attention to any words that have been *italicized* for emphasis.

- Follow the instructions. If asked for a diagram or table you will lose marks if you do not include one. If asked for *four* reasons you will lose marks by giving three, and waste your effort by giving five.
- Take careful note of words like 'describe', 'explain', 'list', 'sketch' and 'briefly'. They are used for good reasons. When you come across such terms, stop and think through what they mean in practice as you work on your TMA.
- To decide how much detail you should include in an answer, look at the number of marks allocated. A short answer will obviously have fewer marks allocated than a detailed description or complex calculation.
- Attempt all parts of a question and make sure that your answers are clearly marked with the question number and the part.
- Before sending a TMA off to your tutor for marking, always read through your answers carefully and check them against the question to make sure that you have not missed anything.

3.3 Presenting answers to calculations

It is important to present your answer to a calculation in such a way that your tutor can understand fully how and why you arrived at your answer. Your tutor can then assess whether you know what you are doing when you get the correct answer (and so see that it wasn't pure guesswork). Your tutor can also see the source of any errors and so explain to you where you have gone wrong. The details that we expect of you in calculations are important aspects of communicating through mathematics. *Usually more marks will be awarded for the steps in a calculation than for the final answer*. Showing all the steps in your working will help you, too. It will keep your thinking clear as you do the question and will make your answer easier to check when you have finished. It will also enable you to understand what you did if you look back at your calculation in the future, for example when presented with a similar task in a later assignment.

It is worth bearing in mind the following guidelines whenever you present the answer to a calculation.

- Set out your answer clearly with words of explanation as appropriate;
- write down any equations you are using, and define the terms that you use in the equations;
- write down the numerical values (with units) of the known quantities in the equation;
- you may need to rearrange the equations so that the unknown quantity is on one side of the equals sign and the known quantities on the other;
- put the numerical values into the equation to obtain the value of the quantity you are calculating;
- remember to write down all steps in the calculation;
- write down the answer with the correct unit and the correct number of significant figures;
- remember to use scientific notation and SI units where appropriate.

3.4 Significant figures in calculations

It is important to quote the answers to calculations to an appropriate number of significant figures. You should review Section 6 of the *Maths Handbook* before attempting the assignments, as this contains detailed information on the correct use of significant figures. It is important to understand that it is incorrect to state more significant figures in the final answer of your question than are present in the values given in the question. You will lose marks if you give answers to more significant figures than is warranted from the information given in the question.

When you do a series of calculations in which each succeeding step uses the answer from the previous step, you need to be careful that you don't lose significant figures along the way. To avoid this, it is good practice to retain an extra digit in intermediate steps in a calculation – the first non-significant figure – and to use this extra digit in subsequent steps of the calculation. Here's an example to illustrate the correct use of significant figures – please refer to Section 6 of the *Maths Handbook* if you are unsure.

Question

The density of gold is 1.928×10^4 kg m^{-3}.

(a) What is the mass of a gold brick that has a volume of 2.2×10^{-3} m^3?

(b) What is the mass of 16 of these bricks?

Answer

(a) Density = mass/volume, so mass = density × volume. So,

mass of one brick = 1.928×10^4 kg m^{-3} × 2.2×10^{-3} m^3 = 42.416 kg = 42 kg to 2 sig. figs.

Here we have quoted the answer to two significant figures because the volume of the brick was given to only two significant figures.

(b) We will calculate the mass of 16 bricks in two slightly different ways. First, we will use the two-significant-figure answer for the mass of a brick (i.e. 42 kg):

mass of 16 bricks = 16 × 42 kg = 672 = 6.7×10^2 kg to 2 sig. figs.

Now we will use the value of 42.416 kg to calculate the mass of 16 bricks:

mass of 16 bricks = 16 × 42.416 kg = 678.656 kg = 6.8×10^2 kg to 2 sig. figs.

Note that the answers that we get by the two methods are different, and this difference arises because of the rounding of the intermediate answer to two significant figures. The second answer is the better answer, because it is the result we would get by combining the first and second parts of the calculation, i.e.

mass of 16 bricks = 16 × 1.928×10^4 kg m^{-3} × 2.2×10^{-3} m^3
= 678.656 kg = 6.8×10^2 kg to 2 sig. figs.

Now, you clearly don't want to go back to the start of the calculation for each successive step, nor do you want to write down all of the digits that are displayed by your calculator and re-enter them for successive steps in the calculation. So a good practice to follow is to retain one extra digit for use in later steps of a calculation. In the gold brick example:

mass of one brick = 1.928×10^4 kg m^{-3} × 2.2×10^{-3} m^3
= 42.4 kg = 42 kg to 2 sig. figs.

Note that here we first recorded one extra digit beyond the two significant figures that are justified by the data, i.e. we recorded 42.4 rather than just 42. We then use the value 42.4 kg in the next step, rather than 42 kg:

$$\text{mass of 16 bricks} = 16 \times 42.4 \text{ kg} = 678.4 \text{ kg} = 6.8 \times 10^2 \text{ kg to 2 sig. figs.}$$

So here are the general rules to follow when doing a series of calculations:

> At each intermediate step, first write down (at least) one extra digit beyond the number of significant figures that are justified by the data, and then round this value to quote the intermediate answer to the appropriate number of significant figures.
>
> In the next step in the calculation, use the unrounded number (with the extra digit) to quote the answer for the intermediate step.

3.5 Using units

At first, many students find using units inconvenient. However, the units are every bit as important as the value, as they give context to the value and ensure that calculations are dimensionally correct. For example, saying 'the length of the object is 3' is meaningless, whereas saying 'the length of the object is 3 m' tells us what we need to know. You should *always* check that you have used the correct units throughout your calculations. In addition, dimensional analysis can help you check if the equations you are using are correct. For more information on this point see the *Maths Handbook*.

3.6 Deciding which equations to use

One of the difficulties that you may have when tackling problems in assignment questions is deciding which equations are relevant. Fortunately, in this course it is not essential for you to *remember* the equations, because you can always refer to the *Standard Equations and Constants* booklet, a copy of which is provided with the *Specimen Examination Paper* and which is also provided in the examination. In most TMA questions (and in **all** exam questions) you are expected to begin your calculations starting with an equation in this booklet rather than one derived from them. On occasions, a TMA question may require you to start from an equation in the books.

There are a number of things that you can do to make it easier to select the appropriate equations in the *Standard Equations and Constants* booklet:

- Make sure that you know the meanings of all of the symbols in these equations. Noting down these meanings alongside the equations will help you to recall them. Note that you are not permitted to take this annotated booklet into the exam.
- When faced with a problem to solve, note down in words the quantities that you are given in the question and the quantities that you are asked to calculate, and write the conventional symbol for each alongside. Then look through your list of equations for those that involve the symbols that you have written down. Sometimes this will lead you directly to the one equation that you need to solve the problem. On other occasions you will find several equations that are relevant and that need to be combined. Obviously, you need to know what situations the equations describe in order to be able to apply them properly.

3.7 Writing explanations and descriptions

We generally give some guidance on what length of answer is appropriate. For short written answers, the advice is usually given in terms of the number of sentences or words. For longer answers, we indicate the number of words that is appropriate. If the question states, for example, 'about 100 words', you should use the number of words as a *guide* to the amount of information and type of answer required. If your answer is much shorter than the number of words indicated in the question, you are likely to have omitted some important information. If your answer greatly exceeds the suggested length, you may have included irrelevant information and your answer may lack clarity. In this case you will lose some of the marks awarded for 'quality of writing'. Where a word count is indicated in a question, you should state the number of words you have used at the end of your answer. This is not necessary for shorter answers where the length is given in the question in terms of the number of sentences. Equations, diagrams and tables, where required, do not count towards your word count.

For many written answers, marks will be awarded for your communication skills. In particular your tutor will look for evidence that

- your account has *coherence*, which means that the topics are presented in a logical order and are clearly linked, allowing your account to flow;
- your writing demonstrates *clarity*, which means that it is clear and unambiguous, with correct use of English, i.e. with appropriate division into paragraphs, correct spelling, sentence construction and grammar;
- your account is written *concisely*, which means that it is approximately within the specified word limit and does not contain irrelevant material or unnecessary repetition;
- any diagrams, tables or graphs included in your account are properly labelled and referred to in your text.

It is important to keep these points in mind as you write your answer as you will lose marks if you fail to demonstrate good communications skills.

Any diagrams should be *your own work*: you may *base* your diagram on a diagram from the course materials but it is unlikely to be suitable without modification.

3.8 Planning a written answer

The first thing to do when tackling a TMA question that requires you to produce a piece of scientific writing is to *follow the advice that we have already given*, and in particular to *read the question carefully* to make sure that you are clear about what you are being asked to do.

The next stage is to *look back over all the relevant course material* (not just the books) and to *make very brief notes* of any concepts, examples, etc. that you might include in your answer. You shouldn't write down every detail at this stage, because you may decide later that it is not appropriate to include some things. But don't forget to make a note of *where* you found each item of information (e.g. page number, section of a DVD-ROM) as you might need to go back later to check on details.

You should then *make a rough plan of your piece of writing*. This should indicate *what* information you are likely to include, the *order* in which you intend to present the information, and the *point* that you intend to make with it. You can produce a plan that is a list of topics, with an indication of the appropriate order,

or you may prefer to produce your plan as a diagram of some sort. Remember that your plan is primarily for your own use and so it does not have to be well presented. You are likely to have second or even third thoughts as you plan your work, so your plan may have many crossings out. There is no need to submit your plan with your answer.

You will then be in a position to *produce a first full draft* of the actual piece of writing. Finally, it is worth organizing your work schedule so that you can put your first draft aside for a few days before you produce the final version that you submit. Possible improvements will be far more obvious when you read the draft again with a fresh eye, and this will make it a lot easier to produce the final version to send to your tutor.

3.9 General presentation of assignments

You can either hand-write your assignments or you can use a word-processor, whichever you find easier and more convenient. As long as your answers are clearly legible and well laid out you will get the same number of marks. As well as leaving a wide margin, space out your answers to allow your tutor room to comment.

If you choose to word-process your answers you should bear the following points in mind.

- It is important that any numbers and units you use in calculations are set out *correctly*, as in the course materials. You should use correct scientific notation; subscripts, superscripts and symbols should be put in by hand if they cannot be printed correctly.
- Be particularly careful with the way you set out calculations. Even if you word-process the main text of an assignment, you may find it simpler to leave a gap so that you can write in equations by hand.

3.10 Sending in your CMA

It is possible to submit your CMA answers either online or by using the CMA forms and envelopes provided. YOU MUST NOT TRY TO SUBMIT USING BOTH SYSTEMS. If you do, then the one which arrived first will be the one which is marked.

To submit the CMA electronically, go to your StudentHome page and find the link under 'Your Course Record' for S207. The submission system is quite simple to use but it would be a good idea to make sure that you know where it is and how to access it well before the cut-off date. If you are unfamiliar with this submission system please read the 'Completing your CMA' section from your CMA submission page.

Once you have entered the eCMA system, please **ensure that you click on the correct course code and assignment number**. You can enter your answers a few at a time and come back and change them as often as you like, but **once you have *submitted* your answers you cannot change them**. It is therefore essential that you carefully check that everything is as you intended and ensure that you have made some response for every question, even if it is 'don't know', before you submit your answers.

Please ensure you submit your CMA in good time and no later than **midnight on the cut-off date (UK local time)** to obtain credit. Those received after that date will be marked 'L' (late) and given a zero score. However you will normally receive feedback on your answers. Note that if you use the eCMA system, your score and feedback (a list of correct response for the questions(s) you answered

incorrectly) will ONLY be available via StudentHome. If you submit your answers on paper, then you will receive a letter with your score and feedback; your score (but not the feedback) will also be available on StudentHome.

3.11 Sending in your TMA

You are expected to submit all your TMAs electronically, using the on-line eTMA system. You can submit a word-processed document, or a scanned version of a hand-written one; advice on how to produce an eTMA will be provided on the Course Website. The eTMA system allows for TMA submission directly to the University 24 hours a day, and either gives you confirmation that your eTMA has been submitted successfully or, if there has been a problem, an error message informing you of the problem and what steps you should take to overcome it. Information about how to use the eTMA system can be found in the following document:

http://www.open.ac.uk/assessment/documents/PPD-eInfobooklet.pdf

as well as in Section 8 of the on-line Computing Guide:

http://learn.open.ac.uk/mod/oucontent/view.php?id=235913&section=8

You can, under certain circumstances, request a paper submission of your TMA. This should, in principle, be for a specific TMA or TMAs. These circumstances can be, for example, if the computer you use for producing electronic TMAs is unavailable for some time; or if typesetting electronically, producing electronic figures and/or incorporating scanned images in the electronic document would take you an unacceptably long time. In order to be allowed to submit on paper, you must contact your tutor and obtain his/her agreement. *Make sure you contact your tutor as soon as possible regarding paper submission.*

If your tutor agrees to you submitting by post, you should be sure to post your TMA in sufficient time to arrive by the cut-off date. Do not send it using recorded delivery or guaranteed delivery; this can cause problems for tutors who are not at home to receive it. Instead, send it by first class post and ask for a proof-of-posting certificate at the post office and be sure to keep a copy of the assignment.

If, for any reason, you are unable to complete your assignment on time, you *must* contact your tutor *before* the cut-off date to discuss possible options. Under exceptional circumstances your tutor may allow an extension but you should not expect this to be longer than seven days. The procedure for late submission of assignments is given in your *Assessment Handbook.* You should not normally expect to receive more than one extension.

TMAs are designed to help you to learn. They direct your attention to important parts of the course and they provide an opportunity for you to assess your progress and to get detailed feedback comments from your tutor. Not surprisingly, that feedback has most value if it reaches you quickly and if it is relevant to what you are studying when it is received. For this reason it is important to submit your TMAs on time.

Delaying submitting your TMA might not be to your advantage. If you are getting behind in your studies, it may well be better to accept that you will not get quite as high a mark and then talk to your tutor about your progress. He or she will be able to suggest ways of getting back on track. Remember that it is always better to submit something than nothing. Because of the way the substitution rule works, submitting an unfinished TMA may serve to raise your continuous assessment score but will never lower it.

Additional information can be found under ‘Submitting TMAs’ in the on-line *Assessment Handbook*.

3.12 What to do when your marked TMA is returned

Your tutor will assess your work according to a set of guidelines provided by the Course Team and will give constructive comments on your answers. When you get your TMA back, it is worth spending some time studying these comments carefully.

Probably the first thing you will be interested in is the mark! The score for each question and the overall score (as a percentage) for the TMA will be indicated in the appropriate boxes on the PT3 form. Below this your tutor will make general comments about your performance on the TMA and will give some general advice on how you might improve your score on the next TMA. Your tutor will also make more detailed comments, probably on the script itself, but sometimes on a separate sheet. The marks for each part of your answer will also be indicated on the script.

You will find various kinds of comment. Your tutor may have:

- commended something you did well, and explained why it was so good;
- corrected a specific mistake;
- written some general advice on how to tackle a particular kind of task;
- referred you to particular parts of the course material where you can find more help.

All these comments are made specifically for your benefit; they should provide valuable feedback on your work, and you can use this feedback to improve what you do in the next TMA. So before you file your TMA away in your Study File, it is important that you read carefully through *all* the comments and think about the implications that the advice has for your next TMA. And you will find it useful to review these comments when you come to do your next TMA.

3.13 Plagiarism and cheating

You should be sure that you are aware of, and abide by, the University's rules on plagiarism as set out in Appendix 1 of the *Assessment Handbook* (http://www3.open.ac.uk/assessment/ug/p7.asp). If you submit an assignment that contains work that is not your own, without indicating this to the marker (acknowledging your sources), you are committing plagiarism.

This might occur in an assignment when:

- using a choice phrase or sentence that you have come across;
- copying word-for-word or equation-for-equation directly from a text;
- paraphrasing the words from a text very closely;
- using text downloaded from the internet;
- borrowing statistics or assembled facts from another person or source;
- copying or downloading figures, photographs, pictures or diagrams without acknowledging your sources;
- copying from the notes or essays of a fellow student;
- copying from your own notes, on a text, tutorial, video or lecture, which contain direct quotations.

TMAs provide a vehicle for assessing your performance during your course and contribute to your overall course result. However they also assist you in understanding your subject and aid your learning on the course. When you

attempt to use the ideas and terms of the course independently, you learn more thoroughly and develop your own writing style and problem-solving skills. You are likely to perform better in examinations if you have learned how to write your own answers to questions in TMAs. By submitting work that is not your own, you are denying yourself the benefit of this valuable learning strategy. Copying the work of others would be counter-productive to your goal of understanding the course and to real achievement. Most students will not wish to take such a negative approach to studying, and the University does not tolerate it.

Although you are encouraged to show the results of your reading by referring to and quoting from works on your subject, copying from such sources without acknowledgement is deemed to be plagiarism and will not be accepted by the University. You are encouraged to collaborate with others in studying, but submitted work copied from or written jointly with others is not acceptable, unless collaboration is required in the particular assignment.

Submitting work that has been done by someone else and persistent borrowing of other people's work without citation are obvious instances of plagiarism and are regarded as cheating. Paying for work from other sources and submitting it as your own is also cheating. It is intellectually dishonest to cheat and thus give one student an unfair advantage over others. If a case of plagiarism is proven, this is a serious offence and the Open University disciplinary procedures will be followed, as described under the Student Regulations SA 1.6 and SD 7.2 at: http://www.open.ac.uk/our-student-policies.

4 Further information

4.1 Preparation material and further physics courses

Extra study resources for several physical science courses and in particular for S207 are available at:

http://learn.open.ac.uk/site/physics-astronomy.

You may want to have a look at this material before the course starts.

If you are interested in studying further physics courses, you should consult both the aforementioned website and the Courses & Qualifications section of the University's website where you should select 'Science' from the undergraduate courses list and then 'Physical Science'. If you require specific advice on courses or their prerequisites, contact a Regional Adviser, or the Science Staff Tutor at your Regional Centre.

4.2 Books you might find helpful

S207 is a self-contained course, designed to be studied without reference to other textbooks. Nevertheless, you may occasionally find it useful to consult a book in order to have an alternative viewpoint. The list below gives some books which might be useful.

1 Dobson, K., Grace, D. and Lovett, D. (1997) *Physics*, Collins Educational. This book is aimed at A-level students and is therefore somewhat more elementary than S207. However, it has been carefully written and is thoughtfully laid out.

2 Lambourne, R. and Tinker, M. (eds) (2000) *Basic Mathematics for the Physical Sciences*, Wiley. This book and the more advanced companion volume listed below (3) are a result of a project in which the Open University participated; they develop mathematical ideas in the notation and style of S207.

3 Tinker, M. and Lambourne, R. (eds) (2000)*Further Mathematics for the Physical Sciences*, Wiley.

4 Sears, F.W., Zemansky, M. and Young, H.D. (1991) *College Physics* Addison-Wesley (7th edn). The 7th edition of this old standard may be useful as preparatory reading. It does not contain calculus notation and does not go as far as S207 in some respects, but it does contain problem-solving hints.

5 Ohanian, H.C. (1994) *Principles of Physics*, W.W. Norton. An exceptionally well written survey of physics with good concise definitions, very clear diagrams and plenty of worked examples. The level of mathematics is somewhat lower than that of S207.

6 Halliday, D., Resnick, R. and Walker, J. (1997)*Fundamentals of Physics*, Wiley (6th edn, extended) (ISBN 0471 392227). This book covers most of the material of S207 at a slightly deeper level. It is attractively produced, thorough, and includes many worked examples and hints on how to solve problems. Some of the calculus goes beyond that used in S207 but, if you wish to buy just one physics textbook, this is the one that the Course Team would most highly recommend.

You will also find links to relevant physics-related websites under ‘Physics resources on the web’ on the course website.

5 Whom should you contact if you have queries or problems?

The table below gives a list of useful contacts if you have difficulties or queries relating to your studies. Your StudentHome page at http://www.open.ac.uk/students provides many points of contact.

Query or problem relating to	**Contact**
Academic aspects of S207; clarification and/or help with the course materials; queries about TMAs or CMAs	Your tutor. Contact details are on StudentHome.
Non-receipt of a marked TMA	First contact your tutor. Then if necessary contact the Student Support Team at your Regional Centre. (In StudentHome click on 'Contact us' for contact details.) Otherwise, contact the OU: In StudentHome click on 'Contact us' and 'Assignments'. Telephone: +44 (0) 1908 654146 Write to: Assignment Handling Office The Open University PO Box 722 Milton Keynes MK7 6ZT
Problems contacting your tutor or anything related to tutor support	The Science Staff Tutor at your Regional Centre. (In StudentHome click on 'study support' for contact details.)
Information about tutorial dates, times and venues	StudentHome/course website or the Student Support Team at your Regional Centre. (In StudentHome click on 'study support' for contact details.)
Non-receipt of, incomplete or damaged course materials, including CD-ROMs; DVDs; requests for replacement materials if you lose or damage items	In StudentHome click on 'Contact us' and 'Materials despatch' Telephone: +44 (0)1908 332633 Email: distribution-helpdesk@open.ac.uk Website: www.open.ac.uk/despatch Please note that despatch dates for your course are given on your StudentHome page. Write to: The Open University 53-63 Dennington Road Wellingborough Northants NN8 2RF

Query or problem relating to	Contact
Computing and multimedia The OU Computing Helpdesk is available to help OU Students and Associate Lecturers install and run course software. They also offer support and assistance with other OU-provided IT services and applications including course websites, problems with usernames or passwords, and other online facilities.	In StudentHome click on 'Contact us' and 'Computing support' Telephone: +44 (0)1908 653972 Email: OU-Computing-Helpdesk@open.ac.uk Website: www.open.ac.uk/computing-helpdesk Write to: OU Computing Helpdesk The Open University Walton Hall Milton Keynes MK7 6AA
Obtaining copies of published articles, literature searches, searching the internet and using other library resources	In StudentHome click on 'Contact us' and 'Library services and resources' Telephone: +44 (0)1908 659001 Email: library-help@open.ac.uk Website: www.open.ac.uk/library Write to: Learner Support Team The Open University Walton Hall Milton Keynes MK7 6AA
Advice for students with disabilities	In StudentHome click on 'Study support' and under 'Services' click 'Services for disabled students' Telephone: +44 (0) 1908 653745 Email: Disabled-student-resources@open.ac.uk Website: www.open.ac.uk/disability Write to: The Student Support Team at your Regional Centre or Disabled Students Resource Team The Open University Walton Hall Milton Keynes MK7 6BY
All other queries, including those about registration, withdrawal, course results, change of name, change of address	In StudentHome click on 'Contact us' Telephone: +44 (0)845 300 6090 Email: general-enquiries@open.ac.uk Write to: The Student Support Team at your Regional Centre or Student Registration & Enquiry Service The Open University PO Box 197 Milton Keynes MK7 6BJ
Comments on the course itself or on the assignments (e.g. suspected errors, suggestions for improvements)	The S207 Course Manager Department of Physics and Astronomy The Open University Walton Hall Milton Keynes MK7 6AA Email: OU-Science@open.ac.uk (Please quote the course code, S207, in the subject field.)